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HARVESTING AND PACKING GRAPES IN CALIFORNIA

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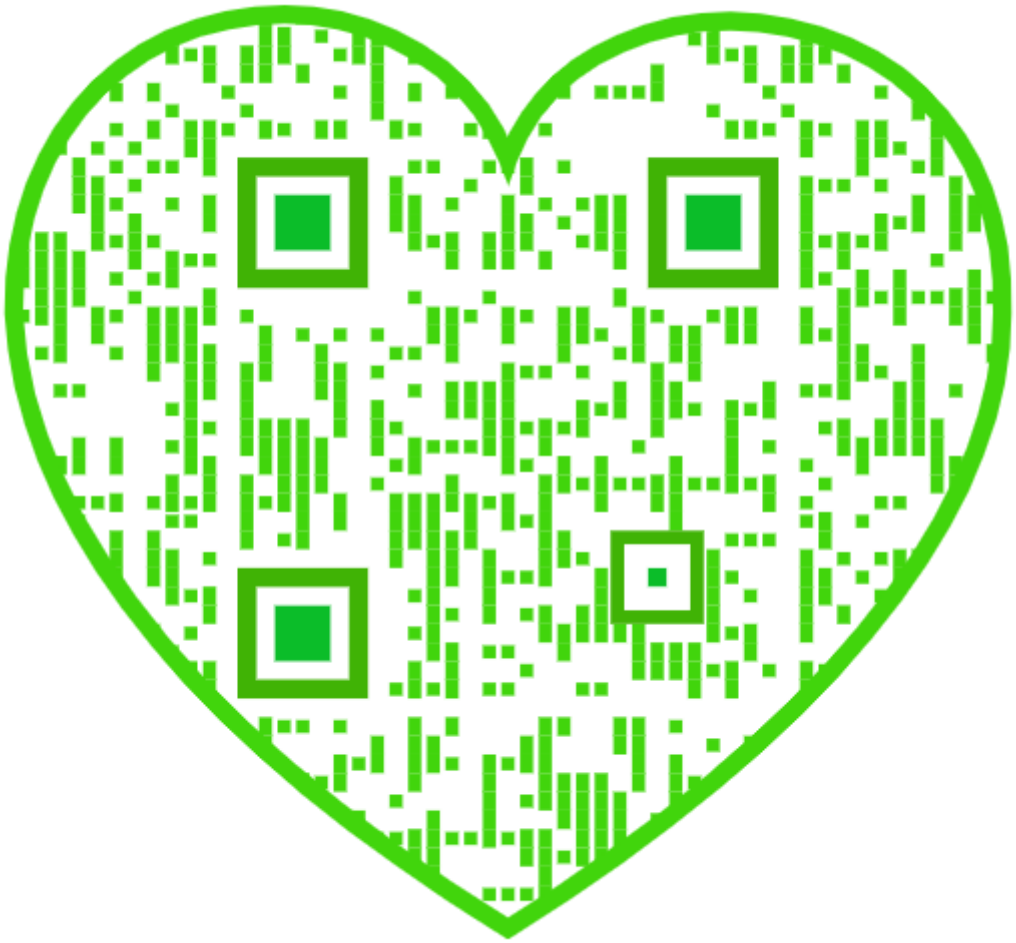

HARVESTING AND PACKING GRAPES IN CALIFORNIA

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INTRODUCTION

The practice of shipping fresh grapes to distant markets in refrigerated railroad cars, although some thirty years old has developed most rapidly since 1916 as is shown on the following chart:

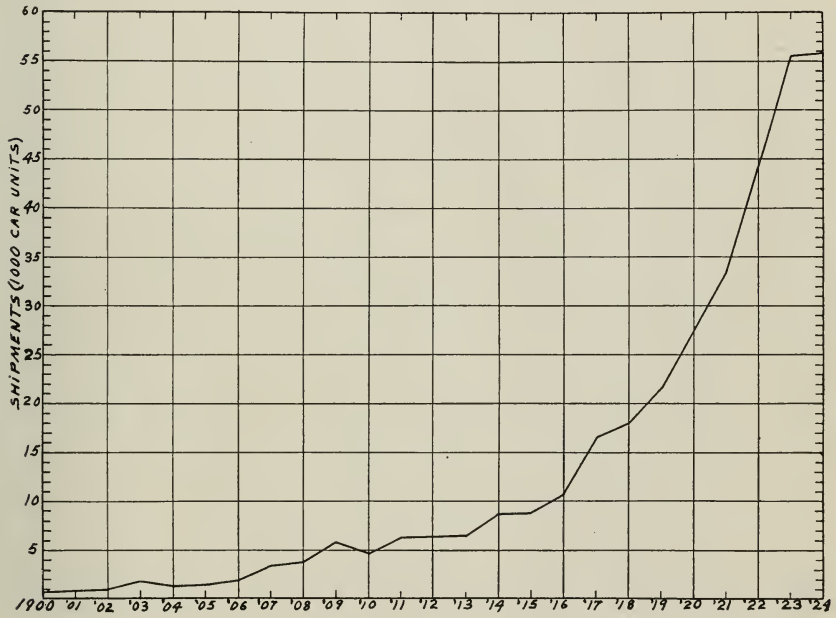


Fig. 1.—Interstate car lot shipments of fresh grapes from California.

New types of packages and new methods of packing have been developed from time to time in efforts to improve the condition in which the fruit reaches its ultimate destination. The various marketing agencies and commercial packing establishments have, for the most part, kept themselves well informed regarding the newer developments in the art of packing grapes. Growers have been slower in acquiring this information because their contact with the actual packing and marketing has been less intimate. The packer and shipper can not deliver grapes to the distant markets in good condition however careful and well informed he is, unless the grower turns the grapes

over to him in first-class condition. Coöperation between grower and shipper is essential if California grapes are to be marketed most advantageously. The grower can not intelligently coöperate with the packer and shipper unless he knows at least in a general way how the grapes are to be handled after they leave his hands.

The principal purpose of this publication therefore is to inform the grower as to the better practices in harvesting and packing grapes in use in California at the present time and thereby assist him in coöperating with the packer and shipper in order to deliver grapes to the market in the best possible condition.

The necessary information was obtained from various sources, principally by observing the methods of the more successful growers and shippers without whose generous coöperation the work would have been difficult or impossible. Our thanks are particularly due to The California Fruit Exchange and its members in various parts of the state, The Earl Fruit Company, The Stewart Fruit Company, The Tracy-Waldron Fruit Company, C. H. Weaver and Company, The Delano Fruit Company; and to Messrs. George Ames, Mecca; M. E. Angier, Lodi; Phil Baier, Lindsay; R. W. Blackburn, Thermal; F. W. Brewster, Arvin; C. B. Cunningham, Mills; W. D. Gibbs, Coachella; G. A. Gordon, Thermal; T. J. Gridley, Coachella; A. B. Humphrey, Mayhew; George F. Johnson, Etiwanda; J. Leffel, Sanger; B. F. List, Exeter; W. B. Minturn, Livingston; W. L. Paul, Coachella; E. F. Pinkham, Exeter; F. Pinkham, Exeter; J. R. Pinkham, Exeter; E. Reed, Reedley; L. Rusconi, Sanger; Emil Steiner, Brawley; B. Towne, Lodi; Chris Westgard, Brawley; R. G. Williams, Lodi.

The authors are much indebted to Professor F. T. Bioletti for his assistance in outlining and directing the work and in the preparation of the manuscript. Thanks are also due to Mr. Fred J. Scott and Mr. W. F. Broderick for their helpful criticism of the manuscript.

HARVESTING

Time of Picking.—The chief considerations in determining the best time, or stage of development, for picking table grapes are:

1. They should be attractive to the consumer in appearance and eating quality.
2. They should have good carrying and keeping qualities.
3. They should reach the market at a time when prices are high.

It is not often possible to pick grapes when all of these factors are at their best. It is usually necessary to compromise. Very early in the

season prices are high, and most of the very early grapes are picked soon after they reach the minimum degree of maturity permitted by law (see below). In mid-season prices are likely to be low, consequently, grapes which ripen at that seasson are usually allowed to reach their prime with reference to appearance, palatability and shipping qualities. Late in the season prices are again high. Therefore, in sections of the state where it is possible to take advantage of these good late markets, grapes are sometimes left on the vines until they are past their best shipping quality.

Ripening, as it interests the grower, consists in a decrease in acidity, an increase in sugar, and the development of the color, texture, and flavor characteristic of the variety. These changes are continuous so long as the grapes remain on the vine but stop as soon as they are picked. (In this respect grapes differ from many other fruits, which continue to ripen after being picked.) Under normal conditions such changes result in gradual improvement until the best stage from the grower's standpoint is reached, after which gradual deterioration ensues. This stage is the proper time to pick and represents a compromise of the three considerations. It is frequently difficult to determine, yet very important. The first of these considerations, namely, the satisfaction of the consumer, should usually be the deciding factor. The second is really involved in the first, for the fruit must not only be good when it is removed from the vine but remain so until it reaches the consumer. The third factor, market price, should be the last of the three considered. Except very early or very late in the season, the fulfillment of the first two will have more influence on the price received than the condition of the general market.

There has been and still is a strong tendency early in the season to market green fruit. Sometimes it sells for an almost fabulous price, but it always has a depressing effect upon the consumer and the market.

This fact is recognized in the fruit and vegetable standardization laws which have been passed by the legislature of the State of California, solely for the purpose of promoting the industry in California by preventing, as far as possible, the shipment of inedible fruit or fraudulent packing. The Standardization law states:* "Grapes shall show a sugar content of not less than 17 per cent Balling scale, except Burger, Emperor, Gros Colman, Pierce Isabella, and Cornichon, which shall show not less than 16 per cent Balling scale."

This is a definition of legal ripeness of grapes in terms of sugar content. It establishes a *minimum*, not an *optimum content*. How-

* California Fruit and Vegetable Standardization Act (Approved June 3, 1921; Stats. 1921, Chap. 719; amended, Stats. 1923, Chap. 315.)

ever, it would be impossible to determine or to enforce an optimum standard; and a legal minimum if enforced, does as much as it seems possible to do by law to promote the shipping of grapes at a stage of optimum maturity.

It is impossible for a grower to comply with this law without having the average sugar content of his grapes several degrees above the legal minimum standard, for: (1) the law applies to every bunch in the shipment, not to an average sample, (2) there is much variation in the sugar content in different bunches at the same time in the same vineyard, (3) the grower can not determine accurately the sugar content of every bunch he packs but must make an approximate estimate, and since he must not err below the minimum, the average sugar content of the grapes will of necessity be above the legal minimum standard, usually at least 2 or 3 per cent.

Hydrometer Sugar Test.—Since the soluble solid matter of grapes is principally sugar, an hydrometer may be used to determine the sugar content accurately enough for picking and shipping. For this purpose an hydrometer of "Balling scale," giving directly the per cent of sugar, is used. (One degree Balling represents 1 per cent of sugar). The following brief outline describes the method of making an hydrometer sugar test:

Materials needed: 1. An hydrometer, graduated in Balling scale. 2. A tall cylinder as deep as the length of the hydrometer and large enough to allow the hydrometer to float freely. Its base should be large enough to insure its standing upright without danger of tipping over. 3. A vessel in which the grapes can be crushed readily. 4. Pieces of cheese cloth 12 inches square to strain the juice. 5. A sample of the grapes to be tested, sufficiently large to furnish a little more juice than is necessary to fill the cylinder.

To make the test: Thoroughly crush all the grapes in the sample. Improper crushing may result in an error of as much as two degrees. After the grapes are crushed, strain the juice through a piece of cheese cloth into a small saucepan or other convenient vessel and pour it into the cylinder. Fill the cylinder to overflowing so that the foam, which forms when the juice is poured in, runs off. Then put the hydrometer carefully into the filled cylinder. Push it down below the point to which it first sinks, so that when released it bobs up and down a few times. When the instrument comes to rest, carefully read the point on the scale at the surface of the liquid. Raise the instrument slightly and let it go, so that it again bobs up and down a few times. Again take the reading. These readings should agree. If they do not, it indicates that the juice contains too much floating solid matter and

should be restrained; or that the diameter of the cylinder is too small and a larger one should be used. Take the reading at the *general level* of the surface and not at the top point of adherence of the liquid to the instrument (meniscus). Carefully take the temperature of the juice tested. If several tests are to be made in rapid succession, the instrument and cylinder need not be washed between tests, but unless they are to be used within a few minutes they should be thoroughly washed and dried.

The hydrometer is graduated to be accurate at 60° F. Above this temperature the observed reading is less than the actual percentage of sugar; below 60° F., it is above the actual percentage. If the temperature is above 60° F., a correction should therefore be added to the reading. If below 60° F., it should be subtracted. This temperature variation is about 0.1 degree for every three degrees above or below 60° F.

This degree represents the percentage of sugar in a pure sugar solution of the same specific gravity as the juice. As this juice contains substances other than sugar, the real sugar concentration will usually be from 0.5 per cent to 2.5 per cent less than the Balling degree or per cent of sugar indicated. These non-saccharine substances will vary so greatly in different grapes that the Balling degree gives only an approximation of the amount of sugar present.

The sugar test is not an absolute criterion of degree of palatability. Some varieties of grapes are more palatable at 18 per cent of sugar than are other varieties at 20 or even 21 per cent. This is due to variation in acidity. Khalili, Rish Baba, and Cornichon, with 17 or 18 per cent of sugar, for example, are often more palatable than Sultanina (Thompson Seedless), Malaga, or Gros Colman, even when the latter are 2 or 3 per cent higher in sugar. Also, the ratio of sugar to palatability of the same variety grown in different sections of the state may vary. However, it is safe to say that no variety of grapes in any part of the state is really good to eat until after it has attained at least 18 per cent of sugar as measured by an hydrometer, and very few varieties in any part of the state reach their best eating quality until they attain over 20 per cent. Some very late varieties never attain 20 per cent sugar in some sections of the state, but those sections should not attempt to grow these varieties for the market.

Picking.—An hydrometer test will give the manager of a vineyard a general idea of when to begin picking, but the pickers themselves must rely on other tests. Appearance and taste of the berries and condition of the stems are the factors generally used. It is impossible to define how a ripe grape should look and taste except to say that it

should be characteristic of the variety. By keeping in mind, however, certain standards of color, taste, and condition which correspond to the required hydrometer test the pickers after a little experience will be enabled to distinguish between ripe fruit and green fruit, according to the legal requirements or to those of the ideal of the grower. Some of the characters or signs of use to pickers in determining ripeness are: (1) *Color and condition of the stem.* This sign can be used only as an index of full maturity, and varies with the variety. Thus, Emperor picked for sawdust packing, where only fully matured fruit is wanted, should show some of the light brown matured-cane color on the stem of every bunch. Sultanina (Thompson Seedless) attains its maximum quality when the stems of the bunches are of a light straw color but are neither wilted nor dry. (2) *Taste.* The greenest grapes of a bunch are those near the apex. Therefore, if taste is used in determining ripeness, berries from near the apex of the bunch should be chosen for tasting. The sense of taste is quickly dulled and if a picker tastes very many bunches he soon loses the ability to tell whether the grapes are ripe or not. (3) *Appearance of the berries.* The color of green and ripe grapes of most varieties and of the same variety in different soils and locations is different, and, while a well colored grape is not necessarily a ripe one, the color is of great use to the picker in judging relative ripeness. Green or white varieties of grapes get more nearly white or yellow as they ripen. The color of red or black grapes usually becomes deeper and more brilliant as the ripening progresses.

The fact that all fruit in the same vineyard or even on the same vine does not ripen at the same time further complicates the situation. Very seldom is it possible to harvest a crop of table grapes and market them in good condition without picking over the vines at least three times. Frequently some of the better growers of fine table grapes go over their vines from five to seven times, picking each time only fruit which closely approximates optimum maturity.

1. Picking Boxes.—The usual practice in harvesting and packing grapes is to pick into "picking boxes" and to haul to a place of packing or to a packing-house where they are placed in a final container for shipment. Picking boxes in use at the present time vary a great deal in size, form, and construction. No. 1 standard (Los Angeles) lugs are frequently used, but these are somewhat too small and too frail to be economical. The picking box preferred by most growers is one large enough to hold about 30 pounds of grapes when the bunches are placed upright in the box and only one layer deep. A box 15 inches wide, 23 inches long, and 8 inches high (outside dimensions),

one of the commoner sizes, fulfills this requirement and is of a convenient size and shape. The sides and bottom of this box should be made of ½ inch material and the ends and cleats of ⅞ inch.

2. Manner of Picking and Placing in Box.—The picker should handle the bunches by the *stem* only. A knife or pair of scissors should be used to remove the bunches from the vine and, while the stem is being cut with one hand, the bunch should be held by the stem with

Fig. 2.—"Stems up" pack in standard No. 1 (Los Angeles) lug. Note how the box is held at a convenient angle for packing by placing one end in another box.

the other. Any bird pecked or decayed berries should be removed. It should be placed in the box *on end* with the stem up. Figure 2 shows a No. 1 standard lug box filled in this manner. To do this requires that the box be tilted. The box may be kept at the proper angle by setting it crosswise with one end in another box (see fig. 2). Handling the grapes and placing them in the box in this manner not only preserves the bloom and prevents bruising but also facilitates removing them from the box in packing.

When the boxes are filled they should be *placed in the shade* and where they can be found easily by the collecting crew.

Transporting the Grapes to the Packing House.—If the rows in the vineyard are 12 feet or more apart it is possible to drive a narrow wagon or "vineyard truck" (fig. 3) through the vineyard and collect the filled picking boxes. Where the rows are less than 12 feet apart, the pickers usually carry the filled boxes to the ends of the rows, or avenues, where they are picked up by a wagon or auto truck. It is

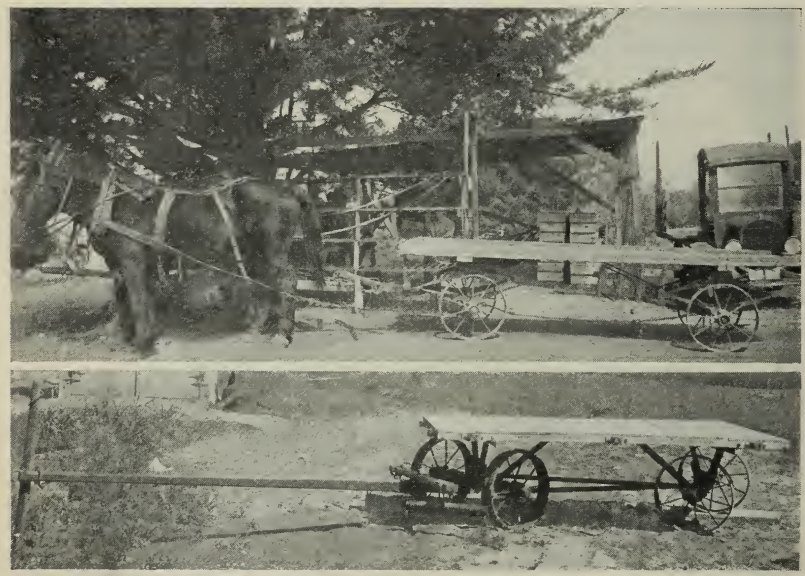


Fig. 3.—Vineyard trucks. Above—a truck with springs. Below—a short-turning truck. Note that the front and rear wheels turn in opposite directions when making a turn. This feature gives the truck a very short turning radius.

not advisable to use a standard wagon or auto truck for driving between the rows to collect the grapes unless the rows are 14 feet or more apart.

For short hauling over loose ground or smooth dirt roads as in collecting the grapes in the vineyard and hauling them to the roadside, vineyard trucks or wagons without springs may be used. Such trucks or wagons, however, should never be used to haul table grapes over macadam roads or pavement more than perhaps a fraction of a mile. For this purpose a light auto truck *on pneumatic tires* is excellent (fig. 4). With a one-or two-ton auto truck having good springs and pneumatic tires, the grapes may be hauled rapidly and with very little shaking. Very large trucks on solid tires are unsatis-

factory, not only because they shake the grapes a great deal (more than do most light trucks) but also because they require considerable time for loading and unloading. The slower speed of the large trucks further increases the delay in delivering the grapes if the distance is considerable. Frequently, too, in a small vineyard where only a few pickers are employed, it takes a day or two to accumulate enough grapes for a load. This delay in delivering the grapes is especially serious in hot weather.

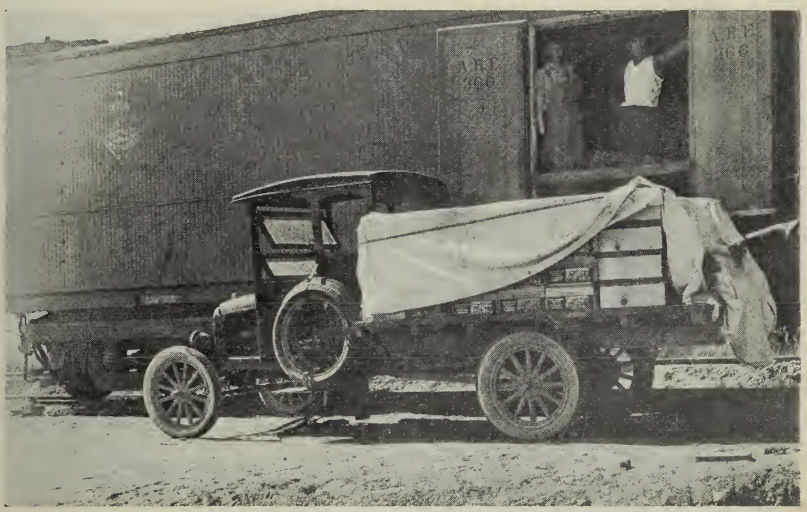


Fig. 4.—A very good type of auto truck for hauling grapes. Note the pneumatic tires on all four wheels.

PACKING

Packing Houses.—Except where grapes are field-packed, some kind of building or shed is almost necessary, but it need be neither elaborate nor expensive. An open shed with dirt floor, a box-nailing bench, enough packing benches to accommodate the packers employed, and a lidding bench will serve the purpose very well for the small vineyardist who does his own packing. In large houses, the equipment justifiable will be determined by the amount of fruit packed and the continuity of its use. Figure 5 (upper) shows a very plain commercial packing house. If the house can be used for packing other fruits also and perhaps even vegetables it will be in use for a considerable part of the year. Under these circumstances, a more substantial building and better equipment are desirable, such as shown in fig. 5 (lower).

Organization for Packing.—So far as the grower is concerned in the packing, there are four general methods of handling the crop. It is impossible to say which of these methods is best as this will vary with many variable conditions.

1. Cash sale on the vines, or f.o.b. vineyard side.—When the crop is sold in this manner, the grower is relieved of all responsibility of packing. The buyer handles the grapes to suit himself.

Fig. 5.—Packing houses. Above—a relatively inexpensive grape packing house. Below—a more elaborate house.

2. Consignment to private concerns.—The grower delivers his grapes either packed or in picking boxes to the individual or corporation which assumes the responsibility of handling them from the point of delivery by the grower until they are sold. For this service a charge of a certain percentage of the gross selling price is made. The grower pays the cost of packing, if the grapes are delivered in picking boxes, and all freight charges. While by this method the grower is relieved of most of the responsibility of handling the grapes, the price

he receives for them depends to a great extent upon the condition in which he delivers them. It is to his interest, therefore, to see that they are properly matured and handled carefully in picking and delivery to the shipping point.

3. Local associations.—In most grape-growing sections of the state, certain growers have formed local associations primarily for the purpose of handling their crop. They build or lease a packing house, employ a manager and experienced packers, and thus pack their fruit. The packed fruit is then usually sold by a marketing agency which charges a certain percentage commission for its services. The local association puts the responsibility for good fruit and careful handling and packing directly upon the growers belonging to the organization.

This local association is useful in many ways to the growers. It necessitates occasional meetings of the members to transact the business of the organization, thus offering opportunities for a discussion of their problems: picking, packing, vineyard operation, and the like. Each grower stands in a position to profit by the experience of his fellow members. There are, of course, difficulties to be overcome in the local association plan. In every community there are growers who insist that practically all the fruit they deliver to the packing house, whether good or bad, must be packed and that as cheaply as possible. They do not realize that only good fruit is worth the expense of packing, shipping, and selling, and that careful packing is essential in order that the fruit shall reach the market in good condition. If such growers as members of an association have sufficient influence, the standard of fruit packed by it will be low.

4. A grower may pack his fruit himself, either in a packing shed or in the field, and ship it under his own label, and may even have his own private sales agency. This system places the entire responsibility of handling upon the individual grower.

Packing House Equipment.—In the packing house, equipment will be necessary for nailing together the boxes, for weighing, moving, and packing the fruit, and for lidding the filled boxes. Boxes or crates for packing grapes may be nailed together by hand or by machine. For hand nailing, a firm heavy bench made of 2 x 4 or 4 x 4 inch pieces of wood with iron nailing sills and with guides to hold the box ends in place while the bottom is nailed on is generally used. Figure 6 shows a machine for nailing boxes. The output of boxes from this machine equals that of several men nailing by hand.

For weighing the fruit, platform scales, "built in" level with the floor, are most convenient. These scales should have a capacity of at least 2000 pounds and should be accurate within one-half pound.

Floor trucks or mechanical carriers may be used for moving fruit from one place to another in the packing house. If trucks are used, they should be of the "clamp-type" of warehouse trucks (fig. 7). The jaws of these trucks are opened and closed by means of foot levers, and the jaws clamp under the ends of the bottom box of a stack of boxes.

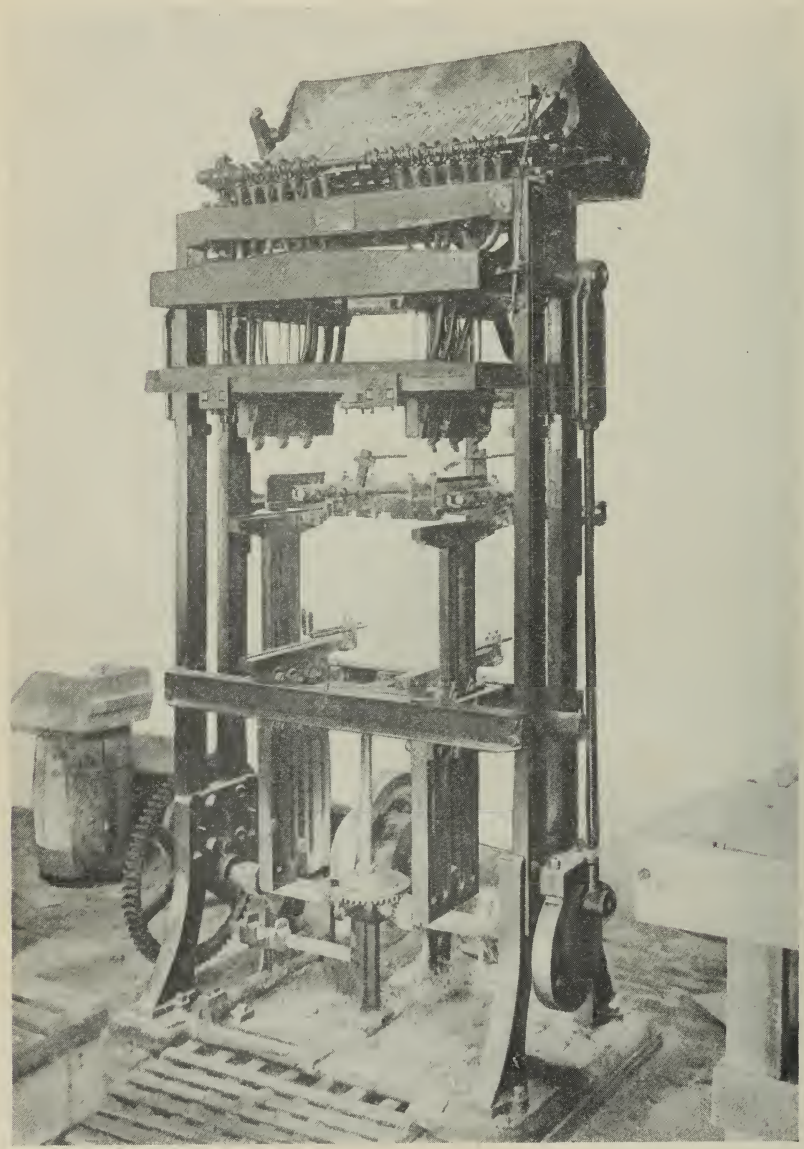


Fig. 6.—A machine for nailing boxes.

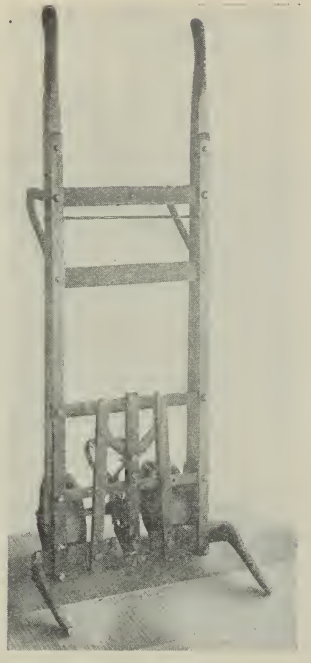


Fig. 7.—Warehouse truck, "clamp type." The jaws which carry the load are opened and closed by means of foot levers.

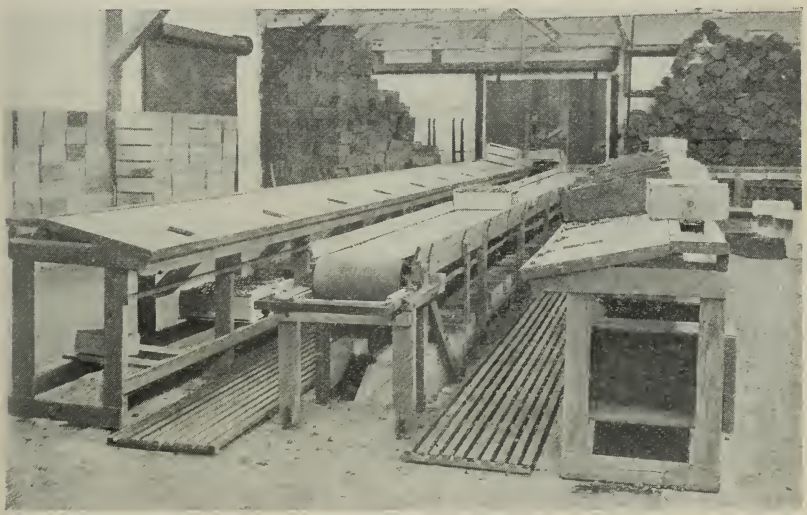


Fig. 8.—One type of packing bench. Note the incline of the top of the bench for convenience in packing, and the holes in the top through which the trimmings and culls are dropped into boxes underneath. Note also the endless belt carrier ("spider") to carry the packed fruit to the lidding bench.

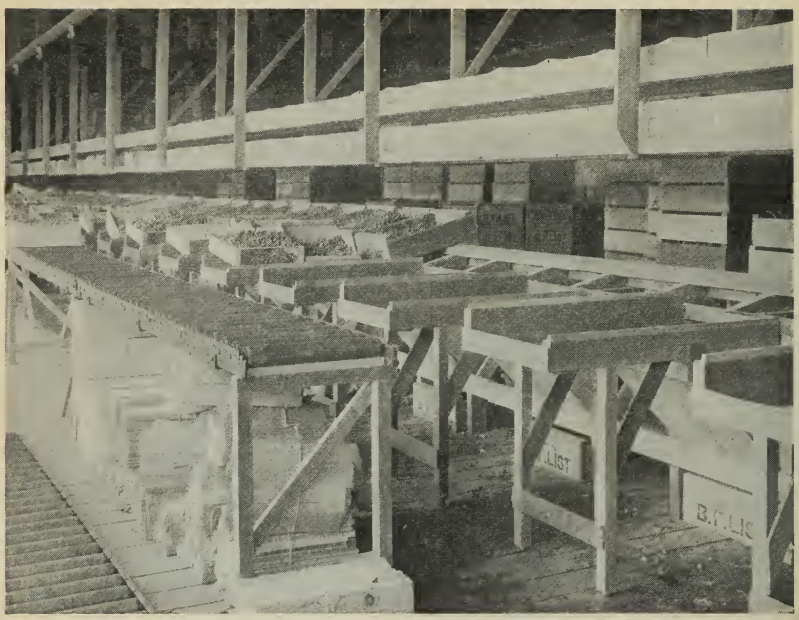


Fig. 9.—Another type of packing bench. Note the chute overhead which carries empty boxes to the packers. Note also the gravity roller type of carrier ("spider"), which carries the packed fruit to the lidding bench.

Fig. 10.—Packing crew at work in a house equipped with packing benches of the type shown in fig. 9. Note the forewoman who closely supervises the packing.

Stacks of full boxes weighing 300 or 400 pounds are easily handled by these trucks without restacking. Mechanical carriers are usually either of the gravity roller type or of the endless belt type shown in figs. 8 and 9.

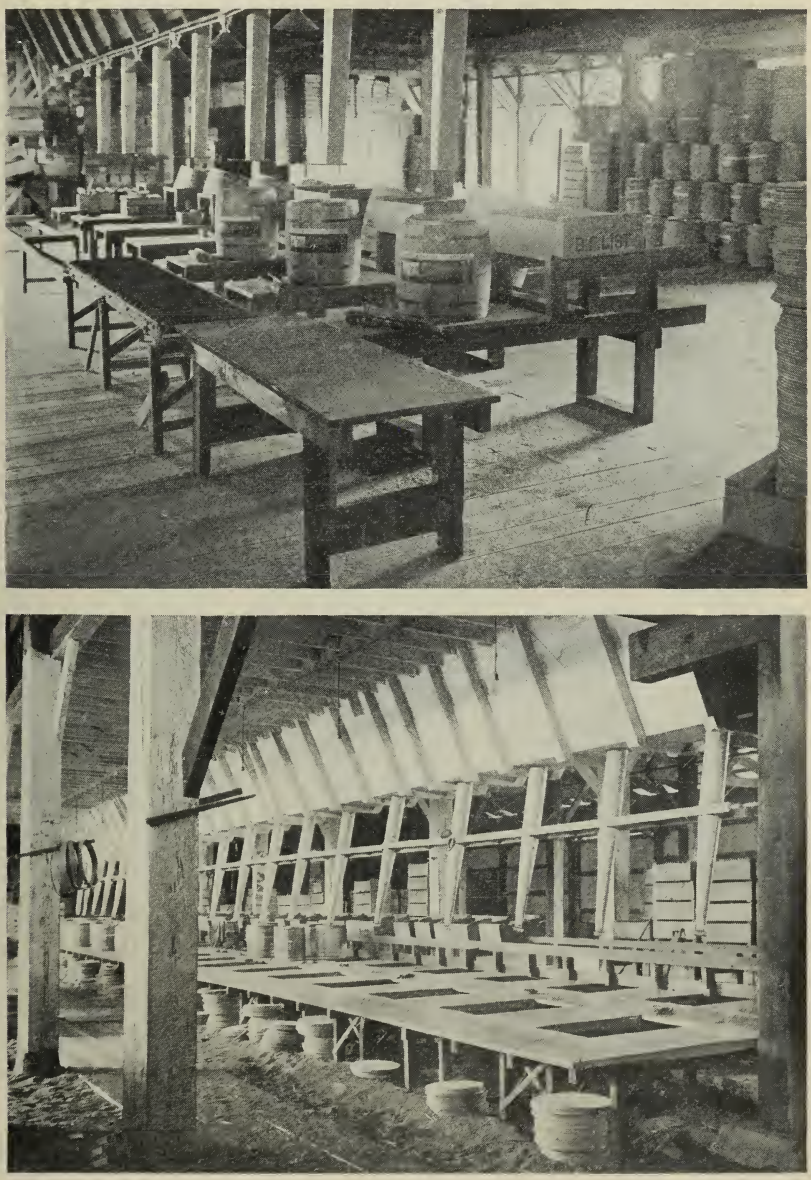


Fig. 11.—Arrangement of two packing houses for sawdust packing in kegs and drums. Note the solid construction of the benches, and the chutes for bringing the sawdust from the overhead storage bins to the packing benches.

Packing benches for lug or crate packs are of various types, from a long flat topped table, similar to that shown in fig. 8, to a system of individual benches with a stall-like arrangement as shown in fig. 9. Figure 10 shows the packers at work in a packing house equipped with benches similar to those of fig. 9.

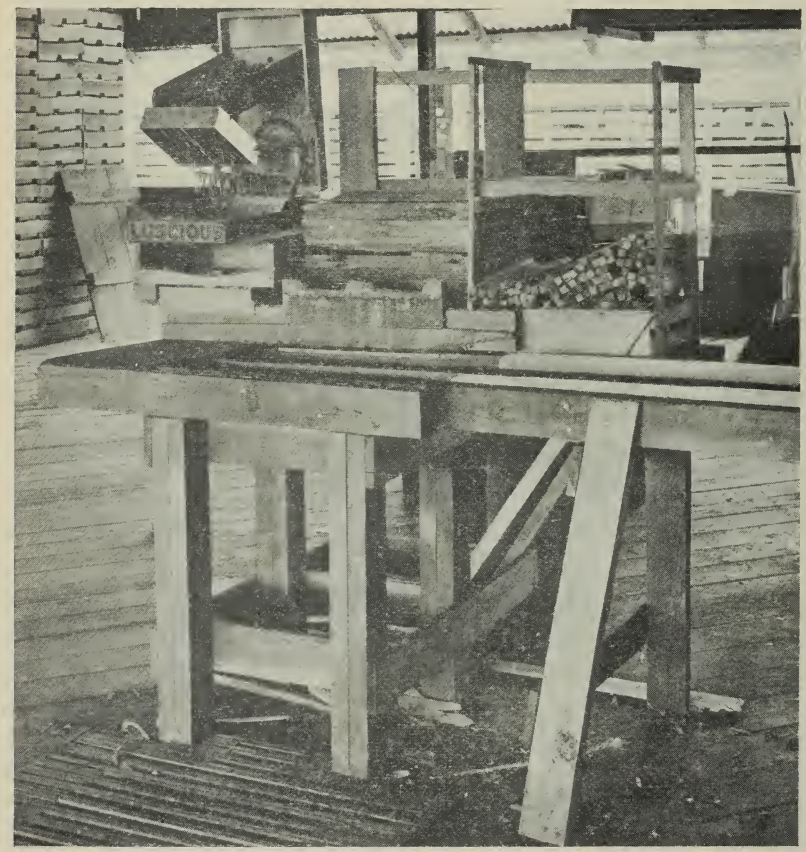


Fig. 12.—A common type of lidding bench. Note the convenient arrangement of the lids in the center, the cleats at the right, and the "stripper" holding the nails at the left.

For sawdust packing, the usual arrangement is similar to that shown in fig. 11. The sawdust is stored in an overhead bin and carried to each packing bench by a spout. These spouts are equipped with a device, usually a wooden or metal slide at the lower end, for regulating the flow of sawdust. The benches for keg or drum packing (see page 17) are usually not so high and are more solidly constructed than benches for lug and crate packing because the keg or drum pack is a larger and heavier pack.

The construction of lidding benches is similar to that of the box-nailing benches, except that the nailing sills are flush with the top of the bench and that there are no guides to hold the box ends in place. Figure 12 shows the type of lidding bench most commonly used.

Arrangement of the Packing House.—A packing house is a workshop and should be arranged for efficient handling of the fruit (fig. 13). Preferably, the receiving platform where the grapes are delivered to the house should be on one side, and the shipping platform, along which is a spur track from the railroad, on the other. The packing

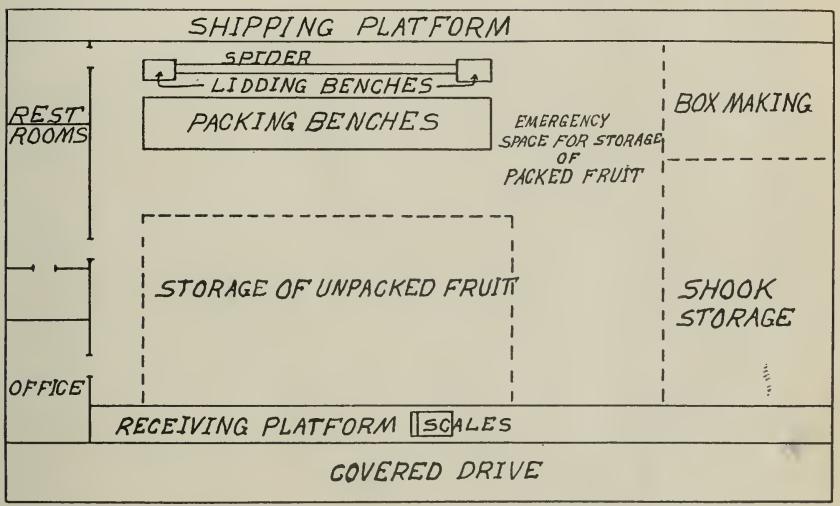


Fig. 13.—Arrangement of a packing house.

and lidding benches should be along the same side of the house as the shipping platform. If the house is not well lighted from the sides, skylights should be placed in the roof. Packers can not do good work in poor light. Storage space should be provided for not more than a day's supply of unpacked and a day's output of packed fruit.

Methods of Packing Grapes.—The work "pack," as used by the grape growers and shippers of California, refers to the place of packing, the type of container, and the arrangement of the fruit in the container. The various grape packs or systems of packing used may be classified as follows:

A. Place of packing.
   1. Packing in the field (field pack).
   2. Packing in specially equipped houses (house pack).

B. Type of container.
   1. "Lugs" (Standard No. 1, Standard No. 2, Standard No. 3, Sawdust lug).*
   2. "Crates."
   3. "Drums" and "kegs."

C. Arrangement in containers.
   1. Jumble pack, in lugs.
   2. Stems up, in lugs.
   3. Plain pack, in lugs or crates.
   4. Cluster pack, in crates.
   5. Sawdust pack, in lugs, kegs or drums.

1. Field pack.—"Field packing" means placing the grapes in their ultimate container in the vineyard as they are harvested. It is the oldest and simplest method. It has long been used for grapes sold on the local market, but only during the past few years have successful attempts been made to pack grapes in this manner for distant shipments. This system has several advantages over house packing. (*a*) It requires less handling of the fruit. The picker removes a bunch of grapes from the vine, examines it for imperfections and trims it, i.e., removes any green, rotten, broken, or dried up berries or straggly portions of the bunch, and places it immediately in the container from which it is not removed until sold. It, therefore, obviates the danger of bruising and of removing the bloom, which occur in the re-handling necessary in house packing. (*b*) If shipping facilities are good, the finished packs can be gathered up from the vineyard and placed in a refrigerated car within an hour after the grapes are picked. The usual time elapsing from the time the grapes are picked until they are placed in the ice car, with the ordinary house systems, is from 12 to 72 hours. *The sooner the grapes are cooled after picking, the better the* condition in which they reach the market. (*c*) If the grapes are of fine quality and require little or no trimming, field packing may be cheaper than house packing.

There are, however, some serious difficulties to be overcome in successful field packing. It has been found very difficult to get capable packers for field work. A good grape picker is not necessarily a good packer. The weather conditions existing in vineyards of the interior valleys, where most of our fine table grapes are grown, are too severe for women and girls who do most of the house packing. Trimming and

* For dimensions, see Regulatory Announcement No. 16, Bureau of Fruit and Vegetable Standardization, State Dept. of Agriculture.

packing can be done much better and more rapidly in a packing house where everything is arranged for convenience and efficiency than under vineyard conditions. If the grapes are not of the best quality and require much trimming, this can be done more cheaply in a packing house than in the field and, in addition, a more uniform pack can be obtained.

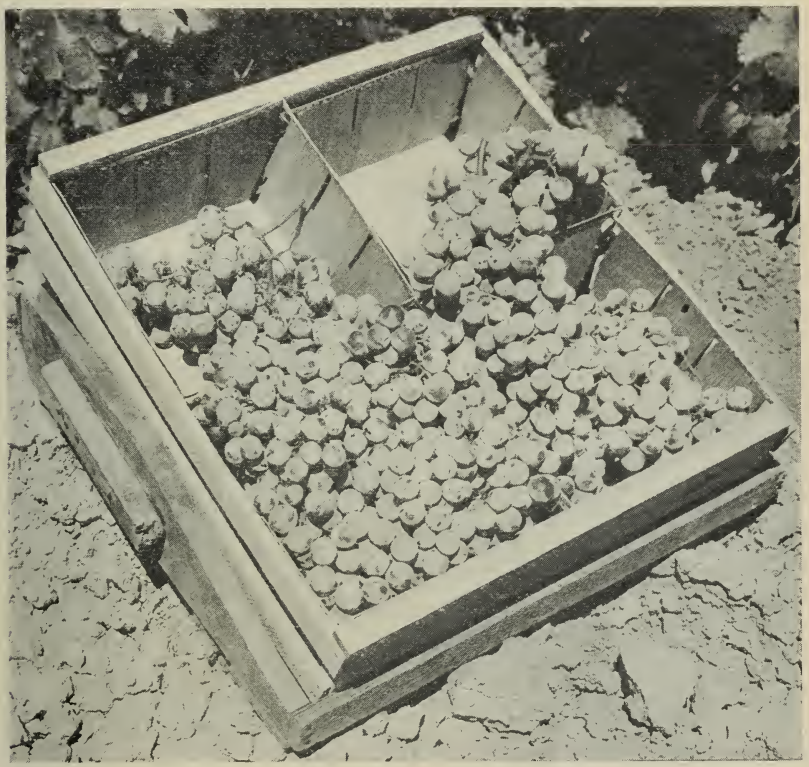


Fig. 14.—Small frame for holding the box at a convenient angle for field packing.

Of the packages recognized as standard by the State Department of Agriculture, those best adapted to field packing are the No. 1 and No. 2 standard lugs. (The No. 1 lug was formerly called the California Shipping or Los Angeles lug.) See pages 24 to 28 for dimensions and discussions of these various packages. The No. 3 or Earl lug and the standard crate are too shallow for ordinary field packing.

The manner of arrangement best suited for packing the No. 1 and No. 2 standard lugs in the field is what is known as a "stems-up" pack (see page 28 and fig. 2). It is virtually the same as that used in filling

the picking boxes (see page 9) but more care must be used in the selection and trimming of the bunches.

Some arrangement for supporting the box so that it slants toward the packer facilitates packing, for the bunches stay in position better. Frequently this requirement is met by placing in another box the container in which the grapes are being packed, with one end down in and the bottom resting on the side of the empty box (see fig. 2.) In this way, it is held at about the proper angle for packing. Sometimes

Fig. 15.—Light portable stand sometimes used for packing grapes in the field.

a special light portable frame (fig. 14) or a portable stand (fig. 15) is used. The grapes should be handled very carefully. The picker should hold the bunch by the stem only while it is being cut from the vine and also while examining and trimming it (see fig. 16). Undesirable berries should be removed from the bunch with blunt pointed scissors or knife and not by tearing them off with the fingers.

The chief items in the cost of field packing are material and labor. (1) Cost of the shook. This varies slightly from year to year and also according to the package used. For the standard No. 1 or No. 2 lugs, the cost of the shook during the past three or four years has varied

between 15 and 20 cents a box. (2) Labor of picking and packing. Since field packing requires very careful work, it is usually paid for on a time basis rather than as piece work. The speed of picking and packing varies greatly with the individual, with the abundance of fruit of proper quality, and with the amount of trimming required. A slow worker with poor fruit may pick and pack only 10 boxes a day,

Fig. 16.—Proper manner of handling a bunch of grapes in picking and trimming for field and sawdust packing.

while a fast worker having plenty of good fruit may pack 60 or 70 boxes in the same length of time. The cost for picking and packing may vary, therefore, from 7 or 8 cents to 50 cents a package. The average cost for both shook and packing, where lug boxes are used and the fruit is abundant and of good quality, is about 30 cents a box. Supervision and hauling usually amounts to at least 5 cents additional.

2. House pack.—When grapes are not sold in the containers into which they are picked, but are repacked into other containers for

sale, it is spoken of as "house packing." For the house pack, the grapes are picked into "field lugs" (see page 8). The bunches should be placed in these boxes in a single layer in an upright position with *stems up* (see page 9).

A good packing house is arranged and equipped for the rapid and easy handling of the grapes through all the operations of packing. The heavy work of moving the grapes and boxes to and from the packing benches is performed by men called "rustlers" or by automatic machinery. The trimming and packing is usually done by women.

The division of labor among workers especially fitted for each operation, picking, hauling, "rustling," and packing, promotes efficiency and uniformity. All operations in the packing house are closely supervised by a foreman or forewoman, or both, whose duty it is to see that the work progresses smoothly and rapidly, and that each finished package comes up to the required standard of quality.

This method of packing with its close supervision makes possible a very uniform pack, not so easily obtained in the field. A more compact, a neater, and a better looking pack is usually put up by trained women of the packing house than by the more or less inexperienced men working in the vineyard. If a great deal of trimming is necessary, it can be done more thoroughly and cheaply in the packing house than in the field.

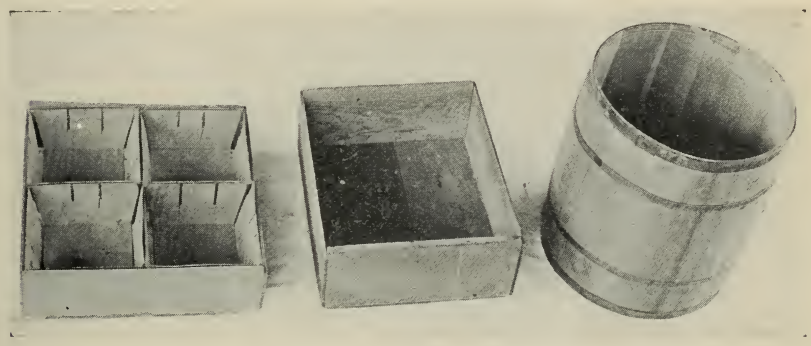
The chief items of expense in a packing house for crate or lug pack are: shook and labels, 12 to 20 cents; box making and lidding 1½ to 2½ cents; packing, 4 to 6 cents; handling the fruit to and from the packing benches, 1 to 1½ cents; loading the car, 4 to 5 dollars or about ½ cent a crate; and overhead, which includes supervision, interest, depreciation, taxes, etc., which will vary in different packing houses but which should not exceed 10 cents a package in any case. This will bring the total cost to between 25 and 40 cents a package.

3. Containers for shipment, lugs, crates, kegs, and drums. (See fig. 17.) The Fruit and Vegetable Standardization Act,* section 7, established the following standard types of boxes for grapes: (*a*) The *standard grape crate* 4¼ inches deep inside by 16 inches wide inside by 17½ inches long outside, with a heavy cleat $^{11}/_{16}$ inches by $^{11}/_{16}$ inches beneath the lid on each end of the box. (*b*) The *California lug box* (also called the Los Angeles lug) 5¾ inches deep inside by 14 inches wide inside by 17½ inches long outside. A variation of ¼ inch is permissible in the width of this box so that 13¾ inches is the width most commonly used. This lug may be used with or without the $^{11}/_{16}$-

* Calif. Fruit and Vegetable Standardization Act. (Approved June 3, 1921; Stats. 1921, Chap. 719; amended, Stats. 1923, Chap. 315.)

inch cleat beneath the lid. (*c*) *Standard grape drum,* for sawdust packing, 14 inches deep by 15½ inches diameter inside measurements—capacity 2642 cubic inches. (*d*) *Standard grape keg,* for sawdust packing—capacity 2642 cubic inches.

4. Lugs.—In addition to the standard containers established by Section 7 of the Standardization Act, the State Department of Agriculture established three additional standard lug boxes June 1, 1924.*



A B C

Fig. 17.—Types of containers used for shipping fresh grapes. A, Crate. B, Lug. C, Sawdust keg.

TABLE 1

STANDARD LUG BOXES RECOGNIZED BY THE CALIFORNIA STATE DEPARTMENT OF AGRICULTURE, BUREAU OF STANDARDIZATION, 1924

Kind of lug	Total depth inside	Depth inside without cleat	Width inside	Length outside	Cubic contents
Standard No. 1 (L. A. lug). (Calif. lug.)	6 7/16 in.	5¾ in.	13¾ in.	17½ in.	1427.3 cu. in.
Standard No. 2 (A. F. W. lug.)	5 7/16 in.	4¾ in.	13¾ in.†	17½ in.	1205.5 cu. in.
Standard No. 3 (Earl lug.)	4 5/16 in.	4¼ in.	13¾ in.†	17½ in.	1094.7 cu. in.
Sawdust lug	7½ in.	.....	13¾ in.†	17½ in.	1650.0 cu. in.

† The regulations of the California State Department of Agriculture specify 14 inches as the inside width but permit a variation of not more than ¼ inch in this width. 13¾ inches, therefore, meets these qualifications, and is the width commonly used.

* Additional Standard Grape Lug Boxes. Regulatory Announcement No. 16, Bureau of Fruit and Vegetable Standardization California State Dept. of Agriculture.

The total depth of the Standard No. 2 and Standard No. 3 may be obtained by using the $1\frac{1}{16}$-inch cleat on the ends beneath the lid, or the ends may be solid of the width specified as the total depth. Neither of these lugs may be shipped as standard packages unless the total depth is as specified. The Standard No. 1, or California lug box, may be used with or without the $1\frac{1}{16}$-inch cleats. The sawdust lug is always used without a cleat beneath the lid.

TABLE 2

Relative Contents of Lugs when Packed

(Calculated from their relative cubic contents)

	In field with fresh grapes*	In packing house with wilted grapes
Standard No. 1	28 lbs. to 30 lbs.	32 lbs.
Standard No. 2	23.7 lbs. to 25.3 lbs.	27.0 lbs.
Standard No. 3	21.5 lbs. to 23.0 lbs.	24.5 lbs.

* The variations in weight of field packs are due to variations in the character of the grapes and the skill of the packers.

All grapes packed without a filler settle more or less in the package during transit; consequently, the boxes are "slack" (not full) when they reach the market. If cleats are used on the ends, the box may be packed as much higher as the thickness of the cleats. The cleats are ordinarily nailed to the box ends only by the nails that hold the lids. When the lids are taken off the cleats are removed also, thus reducing the depth of the box so that the grapes completely fill the remainder. If solid ends are used, there is no practicable means of reducing the depth of the box, and it goes on to the market as a "slack" pack.

5. Crates.—The standard grape crate has been extensively used for some time in California. Its dimensions are $4\frac{1}{4}$ x 16 inches inside by $17\frac{1}{2}$ inches outside. It is made up from pieces as shown in Table 3, and must be used with heavy cleats $1\frac{1}{16}$ inch beneath the lid.

TABLE 3

Pieces Used in Making the Standard Grape Crate

A—Slat Crate	*B—Solid Crate*
2 ends $1\frac{1}{16}$ x $4\frac{1}{4}$ x 16 inches	2 ends $1\frac{1}{16}$ x $4\frac{1}{4}$ x 16 inches
2 top pieces $\frac{1}{8}$ x $7\frac{7}{8}$ x$17\frac{1}{2}$ inches	2 bottom pieces $\frac{1}{4}$ x $5\frac{5}{8}$ x $17\frac{1}{2}$ inches
2 cleats $1\frac{1}{16}$ x $1\frac{1}{16}$ x 16 inches	2 sides $\frac{1}{4}$ x $3\frac{3}{4}$ x $17\frac{1}{2}$ inches
2 cleats $\frac{3}{8}$ x $1\frac{1}{16}$ x 16 inches	2 top pieces $\frac{1}{8}$ x $7\frac{7}{8}$ x$17\frac{1}{2}$ inches
8 slats $\frac{1}{4}$ x $1\frac{1}{2}$ x $17\frac{1}{2}$ inches for bottom and sides	2 cleats $1\frac{1}{16}$ x $1\frac{1}{16}$ x 16 inches
	2 cleats $\frac{3}{8}$ x $1\frac{1}{16}$ x 16 inches

Four chip baskets are commonly used in each crate. The baskets are 4 inches deep and have sloping sides, are 8 x 8 inches on top and 6½ x 6½ inches at the bottom. They are made of thin wood veneer, the top edges being covered with a narrow rim of metal. Instead of the standard four baskets, two larger baskets measuring 8 x 16 inches on top, 6½ x 14½ inches at the bottom and 4 inches deep, are sometimes used for "Cluster packs" or for plain packing of very large bunches.

6. Relative merits of crates and lugs.—Much has been said for and against both containers. Briefly stated, the advantages usually claimed for crates are: (1) ventilation in the center of the pack is better and therefore the grapes hold up better in transit, (2) if the baskets are packed as individual units, one basket may be taken out and sold without disturbing the others, (3) it makes an attractive pack and the buying public is accustomed to it.

The chief objections to the crates are (1) the fruit must be wilted to pack readily. This means a delay of twelve hours or more before the fruit is cooled. (2) The metal tops of the baskets bruise and cut many berries. Both factors reduce the keeping qualities of the fruit.

The chief advantages claimed for lugs are: (1) fresh fruit can be readily packed, (2) it is seldom necessary to cut or sharply bend a bunch for lug packing, (3) packers having but little experience can put up a more presentable pack than in crates. This is of considerable importance to growers who wish to pack in the field where experienced women packers can not be used.

The chief disadvantage of the present lugs, especially the Standard No. 1, is that the large mass of fruit increases its liability to spoil. For grapes of good shipping quality this is not serious. For those of poor shipping quality, e.g., Muscat, this fault can be remedied by using lugs somewhat narrower than the present standard ones and not over 4¾ inches deep.

The first recorded eastern shipment of grapes packed in Standard No. 1, or California lug, was in 1918. In 1920 it was very commonly used. In Table 4 are shown the relative numbers of crates and lugs sold on the auction markets of the U. S. in 1923.*

From these figures it will be seen that for these three varieties, which constitute the bulk of table grape shipments, almost as many lugs were used as crates. The figures given are exclusive of private sales and certain express car shipments on which data are not available.

* Data from the *Blue Anchor*, published by the Calif. Fruit Exchange, 1, No. 1, p. 16, 1924.

The average price for a lug was slightly lower than the average price for a crate. This is explained by the fact that practically all grapes shipped for "juice" purposes are shipped in lugs. These figures include the "juice" stock of the three varieties mentioned which brought less than the better fruit packed and sold for table use.

Sawdust Lugs, Drums, and Kegs.—(See Standard containers used for sawdust packing in California, page 25.)

TABLE 4

RELATIVE NUMBERS OF CRATES AND LUGS SOLD ON THE AUCTION MARKETS OF THE UNITED STATES IN 1923.

Variety	Crates	Lugs
Malaga	2,844,782	1,947,827
Tokay	1,394,341	1,902,216
Emperor	1,002,975	1,075,235
Total of three varieties	5,242,098	4,925,278

Arrangement in the Container—

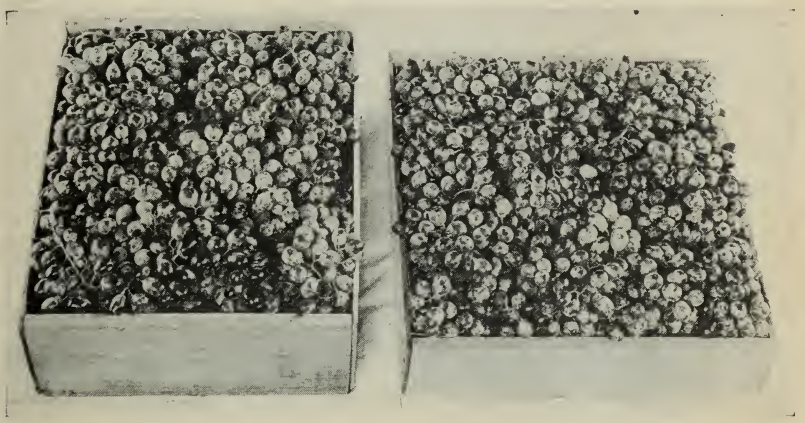
1. "Jumble pack," in lugs. With this method the bunches are placed in the boxes without definite arrangement. It is a very cheap and convenient method for field packing of wine or juice grapes where inexperienced packers only can be obtained, and where a neat finished appearance is not necessary. It is never used for long distance shipments of table grapes.

2. "Stems up," in lugs (fig. 2). For this pack the bunches of grapes are placed in the lug in a more or less upright position with the apices of the bunches down and the stem showing on the top of the finished pack. Because of the tapering shape of the bunches it is usually necessary to lay some bunches horizontally in the bottom of the box to fill up the spaces between the upright bunches. If the grapes are good and require little or no trimming this is a very good and cheap method of packing. It does not require much experience to put up a very presentable pack. Fresh unwilted grapes can be packed readily. If the pickers are careful, practically none of the bloom is removed and the danger of bruising is minimized because the bunches are handled by the free stem only. This method is the best of the common methods for field packing. It is also adapted for use in the packing house with fresh grapes.

The only serious objections that have been raised against this method of packing are: (1) its ragged appearance with all stems

showing, and (2) its settling in transit. The latter objection can be overcome by making the pack as compact as possible.

3. "Plain pack," in lugs or crates (fig. 18). This is the most common method used in packing-houses where experienced packers are obtainable. The bunches in the bottom of the box are placed as compactly as possible but without regular arrangement. The bunches of the top layer are bent or looped so that the apices are brought back to the stems. Each bunch is then placed in the box so that neither the stem nor the apex shows. This places the middle of the bunch, with the finest berries, at the surface of the pack. The top of the



A B

Fig. 18.—Plain pack. A—in lug. B—in crate.

finished pack presents a level unbroken surface of grapes, no stems or individual bunches showing. This "plain pack" can be used readily only with "wilted grapes." Where the stems have been allowed to wilt to make them flexible, the bunches of grapes can be packed in so tightly that very little settling occurs in transit. Fresh grapes packed in this way are usually badly bruised and the berries loosened from the pedicels which increases the spoiling in transit. Moreover, they settle considerably, and the pack upon arrival at the market may be "slack." This, of course, can be overcome by packing the boxes higher and using two cleats under each end of the lid instead of one (double cleating).

4. "Cluster pack," in crates (fig. 19). This type of pack was formerly used for very fine grapes but is now almost obsolete. A few houses, however, have recently begun using it again. The grapes are sorted during or before packing. The very best bunches are selected and packed in "cluster crates," and the remainder packed as "plain

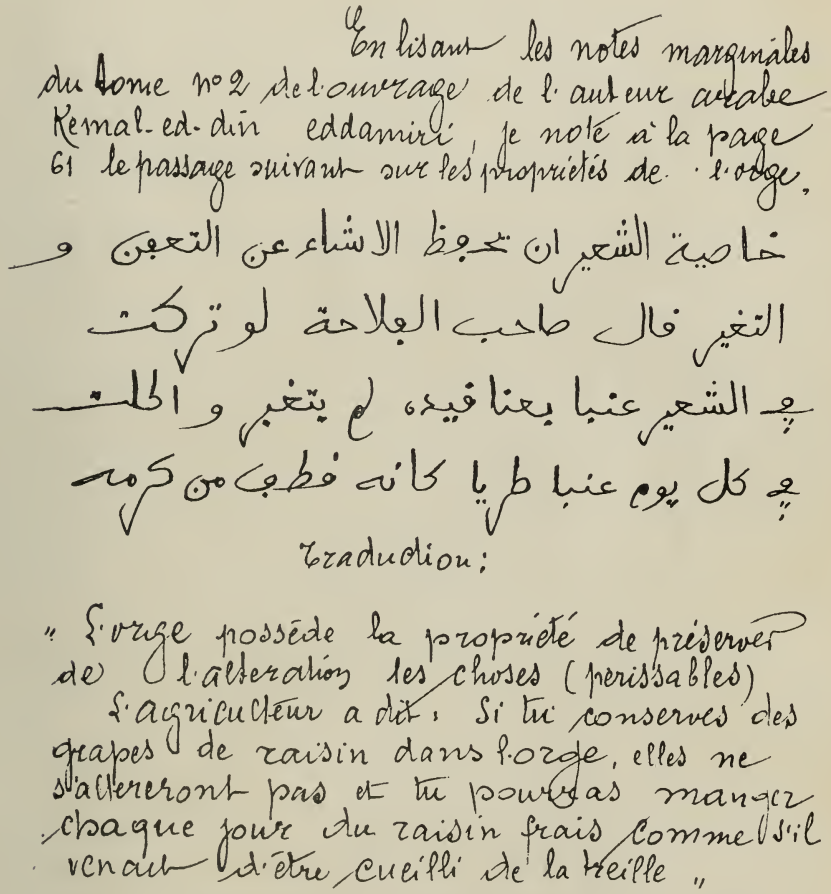
pack.'' The grapes of the ''cluster pack'' brought a much higher price than those packed in the ordinary manner. However, the removal of the finest bunches for the cluster packs, lowered the average quality of the grapes in the ordinary packages. These consequently sold for a lower price than would have been the case had not the best bunches been removed, and the higher price received for the few cluster packs did no more than equalize the lower returns on the remainder.

The cluster pack most commonly used was the ''Star Cluster,'' illustrated in fig. 19. Four large bunches constituted the framework

Fig. 19.—Cluster pack.

of this pack. Those bunches were arranged in the crate with the stems together in the center and apices in the corners. Smaller bunches were placed underneath to raise the large ones to the proper height. Among these four large bunches on the top of the crate were placed four smaller bunches, with their stems in the center and apices at the middles of the ends and sides. When finished the surface gave the impression of an eight-pointed star. A bunch of cheap, bright colored ribbon, of two harmonious colors, was usually placed in the center on top of the grapes before the lid was nailed on. This bunch of ribbon hid the stems and added color to the pack. Properly packed, the cluster pack was the most beautiful pack ever used for grapes. Because of the irregularity of the surface and the extra fullness to which the cluster pack was usually packed, extra cleats were necessary beneath the lid to prevent the grapes being crushed when the lid was nailed on.

5. *Sawdust pack in kegs, drums and lugs.* This pack consists of filling the space between the bunches and berries with specially prepared sawdust when placed in the container. It is considered the best system of commercial packing now in use for grapes that are to be kept for a considerable length of time. The function of the sawdust is to


En lisant les notes marginales du tome n°2 de l'ouvrage de l'auteur arabe Kemal-ed-din eddamiri, je note à la page 61 le passage suivant sur les propriétés de l'orge.

خاصية الشعير ان يحفظ الاشياء عن التعفن و
التغير قال صاحب الفلاحة لو تركت
في الشعير عنبا يعنا فيه، لم يتغير و اكلت
في كل يوم عنبا طريا كانه قطف من كرمه

Traduction:

" L'orge possède la propriété de préserver de l'altération les choses (périssables)
L'agriculteur a dit: Si tu conserves des grapes de raisin dans l'orge, elles ne s'altéreront pas et tu pourras manger chaque jour du raisin frais comme s'il venait d'être cueilli de la treille "

Fig. 20.—Citation in Arabic of grapes packed in barley (see below for English translation).

absorb moisture, and to prevent drying and bruising. The preservation of grapes by packing them in a filler is an ancient practice. A correspondent in Egypt quotes from an old Arab author, Kemal-ed-din Eddamiri "If you keep bunches of grapes in barley they will not decay and you can eat every day, grapes as fresh as if just gathered from the vine" (fig. 20).

For many years Ohanez grapes have been shipped from Spain* into this country packed in ground cork. The difficulty of obtaining cork for this purpose and its high cost in the United States led to the development of the present system of sawdust packing as a substitute.

In the early gold days, Mission grapes were shipped from Los Angeles to San Francisco packed in sawdust. It was later the practice in northern California to pack Mission grapes in sawdust for winter use. The grapes kept well, but after a few months they usually acquired a resinous or pine taste from the sawdust. Mr. A. D. Sheppard when freight manager for the Southern Pacific Railroad invented, about 1898, in San Francisco, a process for deodorizing and blanching the sawdust, and grapes packed in sawdust treated by his process kept as well as or better than in ground cork. Mr. Sheppard's object was to encourage the growers here to raise Ohanez grapes to compete with Spain. The first attempts to grow this variety in California, however, were not successful and the process was never used commercially.

In 1906 the U. S. Department of Agriculture undertook a study of grape packing. The now common practice of packing Emperor grapes in sawdust is a direct result of work done by Professor A. V. Stubenrauch and Mr. C. W. Mann of the U. S. D. A.† Their experiments included exhaustive tests of many kinds of packing material, including corn pith, shredded paper, wheat bran, corn meal, cocoanut pollen, ground and shredded tule, ground, granuated, and shredded cork, and sawdust from various available woods. Redwood sawdust, from the first, gave better results than any other "filler" material used.

The first commercial test shipments in sawdust were made in 1911. Two carloads of Emperor, one to Chicago and the other to New York, returned fair prices (about $1.50 for a 27-lb. drum). Since 1911 shipments have increased very rapidly. During the season of 1923, over 24,000 kegs of Emperors were packed in this manner.‡

Sawdust suitable for grape packing must meet certain requirements. (1) It must not be too fine. (2) It must be free from sharp splinters. (3) It must be *dry*. (4) It must be free from objectionable odors. Redwood, fir, and spruce are now the source of the sawdust used in grape packing. One is considered as good as another so far as preserving the grapes is concerned. The white sawdust from fir and spruce is considered by some to make a more pleasing contrast with

* These importations were stopped by Federal Quarantine in January, 1924, to prevent introduction of the Mediterranian Fruit Fly, the fly having been found in shipments of Ohanez to this country.

† U. S. Dept. Agr. Bulletin 35: 1–31, 1913.

‡ Estimate of Mr. W. F. Broderick, California Barrel Company, San Francisco, California.

the red color of Emperor grapes than the darker sawdust from redwood. The sawdust as it comes from the mills is bolted, fanned, and graded to remove the fine material and splinters and then kiln dried. As a rule, less than 10 per cent of the original sawdust appears in the refined product suitable for packing grapes. This prepared redwood, fir or spruce sawdust as used at the present time in California is superior to the Spanish ground cork. The chief reason for its superiority is its greater moisture absorbing capacity, which keeps the grapes drier and thus lessens spoiling.

Pine sawdust is unsatisfactory because of the difficulty of getting it free from splinters. The high resin content may also be objectionable.

1. Standard containers used for sawdust packing in California.—These are of three types: (*a*) Kegs made of light wood, chiefly fir. These kegs must have a minimum cubic content of 2642 cubic inches. (*b*) Drums of the same capacity, 14 inches deep by 15½ inches diameter (inside) cylindrical instead of barrel-shaped, and constructed of wood veneer, cardboard, or both. The keg is somewhat more substantial than the veneer or paper drums, but its cost is a little greater. (*c*) Sawdust lugs, 7½ inches deep inside by 13¾ inches wide inside by 17½ inches long outside. These are made as tight as possible by using somewhat heavier shook than that used for the other standard lugs and lining with paper. The lugs cost less than kegs or drums and the labor of packing them about the same. They can be handled and packed in car or storage more conveniently than kegs or drums. Their smaller size makes them more convenient for retailers to handle. They are, however, not so substantial as kegs.

2. Manner of packing.—In packing a keg or a drum, from 33 to 34 pounds of grapes and 10 to 12 pounds of sawdust are generally used. A layer of sawdust, not over one inch deep is first put into the keg. Then a layer of grapes, about one-third of the total amount, is carefully laid uniformly over the bottom layer of sawdust. More sawdust is added and the outside of the drum pounded lightly with rubber tipped wooden mallets. A mallet is held in each hand of the packer and the keg struck lightly but rapidly, alternately on opposite sides until the sawdust has completely filled the spaces between the grapes. The keg or drum is packed in either three or four layers. If in three layers, the second layer, about one-third of the total amount, is carefully laid in like the first. More sawdust is added and the keg again pounded lightly to sift the sawdust thoroughly into and among the bunches of grapes. The remainder of the grapes is then placed in the third or top layer in the same way as the other two. If four layers are used, the grapes of the second and third layers are laid around the *outside* of the

keg leaving a vacant space three or four inches in diameter in the center (fig. 21A). This space is filled with sawdust and thus the massing of grapes in the center of the keg is avoided. If grapes are to be held in cold storage, this method greatly reduces spoiling. The fourth or top layer, about one-third of the total, is laid in like the first or bottom layer (fig. 21B). The sawdust is sifted into each layer of grapes by tapping the outside of the keg as described above.

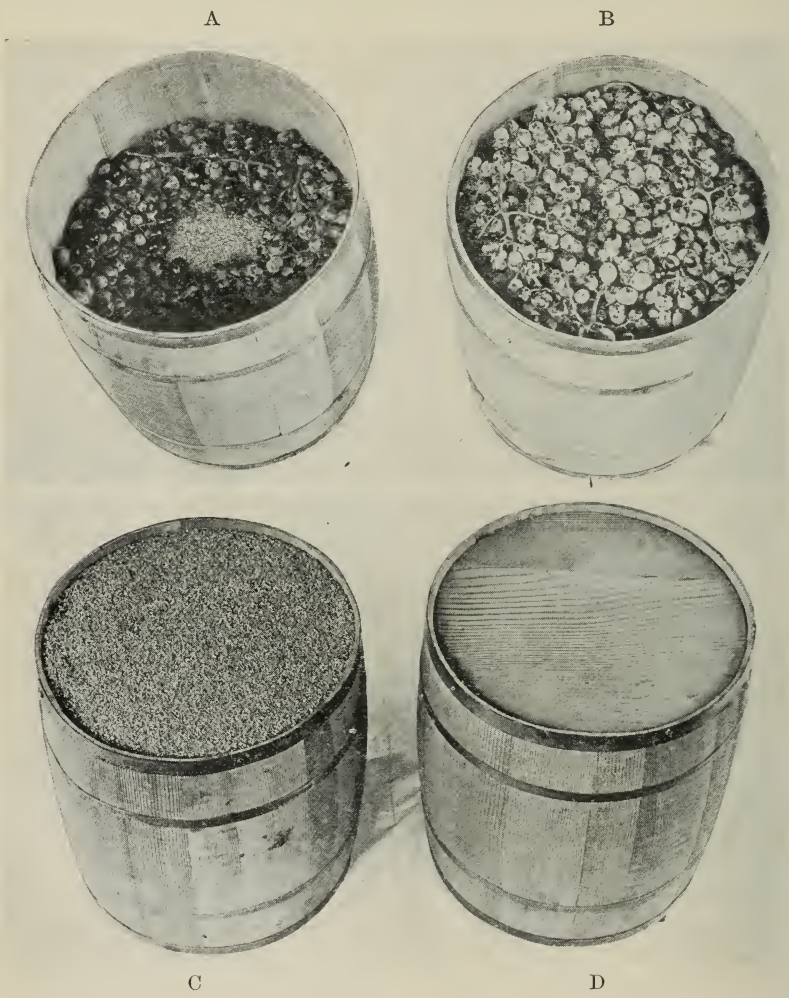


Fig. 21.—Packing a sawdust keg.

A. Manner of placing the second and third layers where four layers are used.
B. Manner of placing the bottom and top layers.
C. The keg completely filled and ready for the head.
D. The finished pack.

When finished, the top layer of grapes should be covered to a depth of about a half inch to one inch with sawdust, which should be just a little higher than the groove for the head, so that when the head is put in, there will be no slack and hence no shaking or settling of the grapes in storage or transit (fig. 21 C and D).

In packing lugs from 23 to 24 pounds of grapes and about 7 pounds of sawdust are used. The grapes are placed in two layers and the sawdust settled into and among the bunches of grapes by shaking and jolting the box lightly up and down, one end at a time, instead of by hammering with mallets.

3. Quality of grapes to be packed in sawdust.—Since packing in sawdust is more expensive than packing in lugs or crates, it is justifiable only for *high class grapes of the best keeping quality,* which can be held in storage until other grapes are off the market.

Grapes for sawdust packing should be *selected in the vineyard.* Several pickings should be made, only fruit suitable for such packing being taken. Careful handling of the fruit can not be too strongly emphasized. Any trimming necessary should be done in the field by the pickers, where damaged or inferior berries should be removed from the bunches with blunt pointed scissors. They should never be taken out with the fingers. Fruit of the first crop only should be taken. Second crop fruit (that which is borne on laterals from the main shoot) is unsatisfactory because of small compact bunches and immature and soft berries. The bunches should be well shaped, neither too compact nor too straggly and at least of medium size. The stems should be well matured, hard, and woody. This is an indication of the full maturity of the grapes. The berries should be well matured but not over-ripe, and should be of good size and color. Small berries, so long as they are few and sound, should not be removed, for other berries may be injured in so doing.

Efforts have been made to establish legal standards of quality in addition to the usual requirements for lug and crate packed grapes. These efforts have not been entirely successful, but probably with time and experience suitable standards will be worked out and enforced. Since the buyer before purchasing can not examine grapes packed in sawdust as easily as those in ordinary lugs or crates, he must rely on legal standards or reputable brands to avoid disappointment.

4. Varieties suitable for sawdust packing.—A fairly loose bunch and a firm, tough-skinned, long-keeping berry are essential for successful sawdust packing. Up to the present time only two varieties, Emperor and Ohanez (Almeria), have met these requirements to a sufficient degree to be handled in this manner on an extensive com-

mercial scale. Considerable difficulty has been experienced in California in growing Ohanez successfully; so that the Emperor is the principal variety packed in sawdust. Attempts have been made to handle Tokay, Malaga, Cornichon, Black Ferrara, and others in this manner, but these attempts have usually met with failure.

5. Cost of sawdust packing.—The cost of the materials and labor for sawdust packing in kegs is from about 3 to 4 cents a pound, and for lugs from about 2 to 3 cents.

SHIPPING

Loading and bracing of cars.—The manner of loading and bracing standard refrigerator cars is specified by the railroads operating in California, in "Pacific Freight Tariff Bureau Circular No. 16." The necessity of solid regular packing and careful bracing and "stripping" (bracing with laths) according to the instructions issued by the railroads can not be too strongly emphasized since these precautions are necessary to prevent the shifting of the load in transit. Regular stacking is very important for the circulation of air through the load and therefore the cooling of the fruit is to a large degree dependent upon the spacing of the boxes, lengthwise and vertically in the car. If one stack of boxes is placed so that these air spaces are obstructed, the lengthwise movement of the air through the load is cut off. Worse still, if one or more layers of boxes are placed so that there is no free opening vertically through the load, the vertical movement of the air is cut off and the cooling of the upper layers retarded. Figure 22 shows the manner of placing the boxes in the car and of stripping to prevent the shifting of the load crosswise of the car.

Refrigeration in Transit.—The standard refrigerator car is built with an ice compartment at each end. Refrigeration of the load in the middle compartment is accomplished by means of the circulation of the air which passes down through the ice at each end of the car, into the main compartment through screens in the bulkheads near the bottom, up through the load, and back into the ice compartments through another set of screens in the bulkheads near the top. The difference in specific gravity (weight) between the column of cold air in the ice compartments and of the warm air in the main compartment causes the circulation. Figure 23 is a chart showing the temperatures obtained in a standard refrigerator car in transit with normal icing. The shipper can do a great deal to promote the efficiency of refrigeration in transit by regular loading so that the air passages lengthwise and vertically through the load are not obstructed. The car should

be cold when loaded. This means that the ice bunkers should be filled at least twelve hours before loading. During the course of loading the doors should be kept closed whenever possible. The railroads, of course, take care of all icing in transit.

Pre-cooling Before Shipment.—Several experimental plants have been erected in California and used for pre-cooling grapes. While undoubtedly pre-cooling is of value in reducing deterioration in transit, the consensus of opinion among shippers is that the overhead and operating expenses of a plant for grapes alone, where it would be in use only a few weeks during the year, are prohibitive.

Fig. 22.—Interior of a standard refrigerator car showing the manner of loading and "stripping."

Use of Salt with the Ice in Refrigerator Cars.—When salt is added to ice, the melting point of the ice is reduced. The addition of 2 per cent of salt will reduce the temperature of the melting ice to about 30° F., and 5 per cent salt to about 27° F. In a recent refrigeration test trip conducted by the Standardization Department of the California Fruit Exchange in the interests of the California Growers' and Shippers' Protective League, an accurate check was kept of the temperatures obtained in various parts of the load of six cars, enroute from California to Chicago and New York. To one of these cars which was loaded with plums and figs at Newcastle, California, salt was added to the ice in the bunkers. Regarding the use of salt with the

ice in refrigerator cars loaded with fresh fruit, the report of this trip states:* "The addition of salt to the ice in the bunkers aided in reducing the temperatures in the top of the load, but salt must be added

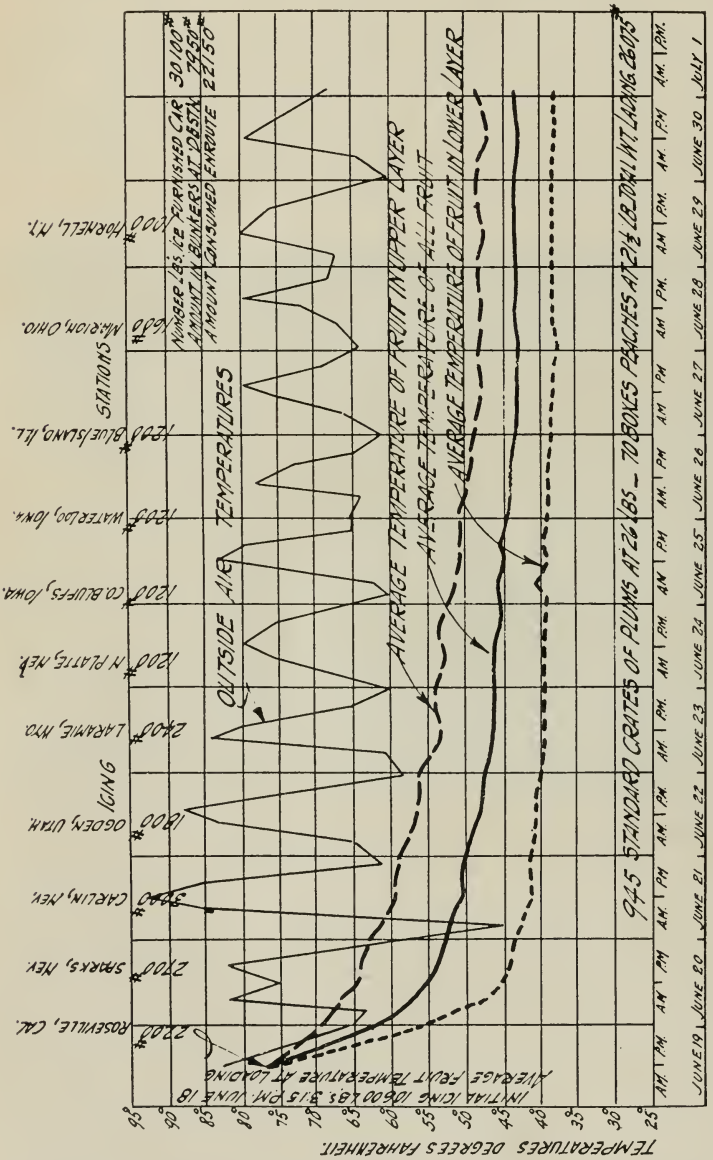

945 STANDARD CRATES OF PLUMS AT 26 LBS. - 70 BOXES PEACHES AT 24 LBS. NET LOADING 28,075
AVERAGE TEMPERATURE OF FRUIT IN UPPER LAYER
AVERAGE TEMPERATURE OF ALL FRUIT
AVERAGE TEMPERATURE OF FRUIT IN LOWER LAYER
OUTSIDE AIR TEMPERATURES
NUMBER LBS. ICE PURCHASED CAR
AMOUNT IN BUNKERS AT DESTN.
AMOUNT CONSUMED ENROUTE
30100#
7950#
22150#
INITIAL ICING 10600 LBS. 3:15 PM JUNE 18
AVERAGE FRUIT TEMPERATURE AT LOADING
ICING STATIONS
ROSEVILLE, CAL. 22100#
SPARKS, NEV. 2700#
CARLIN, NEV. 3980#
OGDEN, UTAH 1800#
LARAMIE, WYO. 2400#
N. PLATTE, NEB. 1200#
CO. BLUFFS, IOWA. 1200#
WATERLOO, IOWA. 1200#
BLUE ISLAND, ILL. 1200#
MISSION, OHIO. 1600#
HORNELL, N.Y. 1000#
TEMPERATURES DEGREES FAHRENHEIT
95° 90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25°
JUNE 19 | JUNE 20 | JUNE 21 | JUNE 22 | JUNE 23 | JUNE 24 | JUNE 25 | JUNE 26 | JUNE 27 | JUNE 28 | JUNE 29 | JUNE 30 | JULY 1
AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM. | P.M. AM.

Fig. 23.—Temperature of the fruit in transit with *normal icing*. Record of temperatures in P. F. E. 7033, plums and peaches—Loomis, California to New York, N. Y., loaded 10 high. Standard refrigeration. Route, S.P.—U.P.—I.C.—I.H.B.—Erie. (Courtesy of Standardization Department, California Fruit Exchange.)

* Refrigerator test trip of six cars of plums and other deciduous fruits from central and northern California points to Chicago and New York City, June 19 to July 1, 1924. Conducted by the Standardization Department of the California Fruit Exchange in the interests of the California Growers' and Shippers' Protective League, San Francisco, California, pp. 10–11.

carefully. It was found that a 2 per cent mixture of ordinary rock salt added to the Newcastle car just after loading was completed, resulted in bringing the temperature at the top of the load down to 45 degrees within one day, as compared to six days in getting the temperature down to 55 degrees in a car not salted. The temperature in the bottom of the load was pulled down to about 40 degrees at the end of one day, but, to show that extreme care must be exercised in adding salt, the temperature in the coldest part of the load, at the bottom layer near the ice bunkers, had dropped to 29 degrees by the time the Newcastle car reached Ogden, Utah. Instructions were then given to stop salting at re-icing stations, except under special orders.

"Our recommendation with reference to the use of salt would be that, while extreme care must be used, a light mixture of from 2 to 4 per cent of salt at time of loading and at first re-icing is advantageous in reducing car temperatures promptly and in lowering the spread between the top and bottom layer temperatures. The salt should be added after the car doors are closed, otherwise a lot of refrigeration, created from the rapid melting of the ice, is lost. The salting record of the Newcastle car was as follows: 250 pounds added at Newcastle, California; 112 pounds at Sparks, Nevada; 64 pounds at Carlin, Nevada; 27 pounds at Laramie, Wyoming; and 20 pounds at Waterloo, Iowa. The amount of salt added is always based on the amount of ice added and not on the total amount of ice in the bunkers. From 250 to 300 pounds is enough to add at point of origin. Slightly larger quantities might be used without danger. However, the use of even a small percentage of salt is inadvisable unless the car is equipped with a floor rack, basket ice bunkers and solid, insulated bulkheads."

Figure 24 is a chart showing the temperatures obtained in this car.

The following charges are made (1924 season) by the carriers where salt is used with the ice:*

Where 2% salt is furnished 5% of stated refrigerator rate
Where 3% salt is furnished 7½% of stated refrigerator rate
Where 4% salt is furnished 10½% of stated refrigerator rate
Where 5% salt is furnished 12½% of stated refrigerator rate

Where salt is used with initial icing only or with initial icing and first re-icing only, a flat charge of $3.50 will be made for the service of salting, regardless of the per cent of salt used—not to exceed, however, a maximum of 5 per cent salt.

* Data from *The Blue Anchor*, published by the California Fruit Exchange, Vol. 1, No. 1, p. 13.

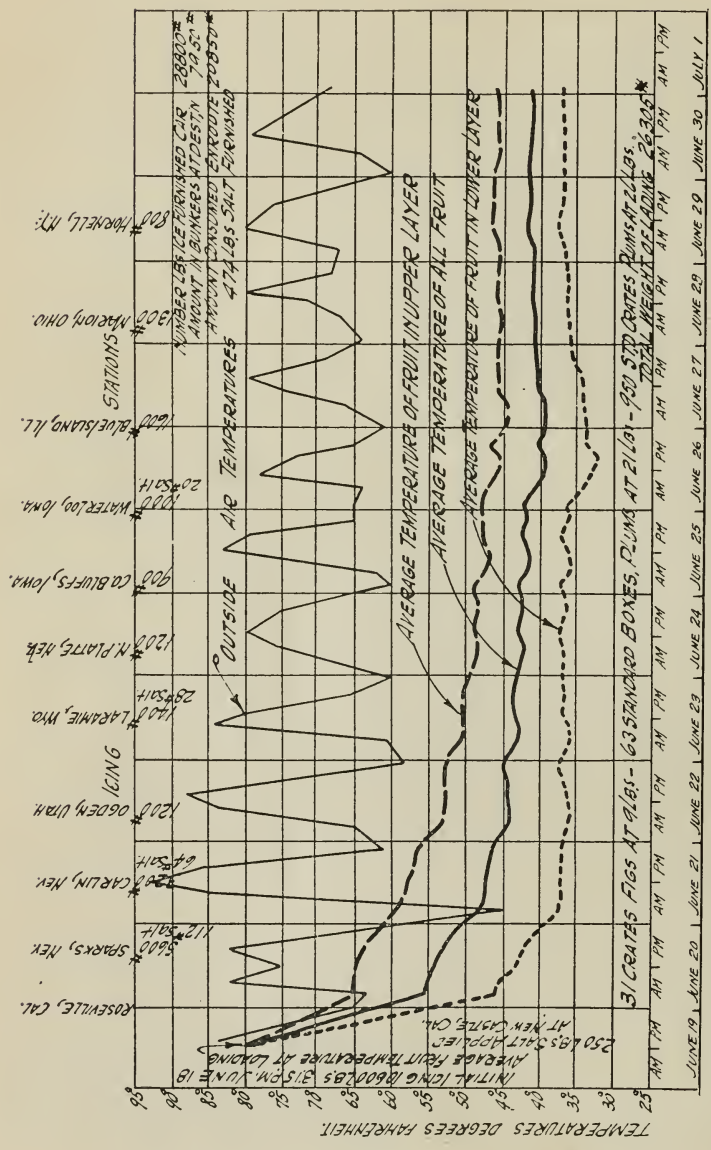

TEMPERATURES DEGREES FAHRENHEIT
OUTSIDE AIR TEMPERATURES
AVERAGE TEMPERATURE OF FRUIT IN UPPER LAYER
AVERAGE TEMPERATURE OF ALL FRUIT
AVERAGE TEMPERATURE OF FRUIT IN LOWER LAYER
INITIAL ICING 18000 LBS 3 PM JUNE 18
AVERAGE FRUIT TEMPERATURE AT LOADING
250 LBS SALT PER ICER
AT NEW CASTLE, CAL.
3 CRATES FIGS AT 9.8°-
635 STANDARD BOXES PLUMS AT 21.3°- 450 STD CRATES PLUMS AT 21.6°
TOTAL WEIGHT OF LOADING 263035#
NUMBER LBS ICE FURNISHED CAR 28800#
AMOUNT IN BUNKERS AT DESTN 7935#
AMOUNT CONSUMED EN ROUTE 20865#
AMOUNT USED AT DESTN 4774 LBS SALT FURNISHED
STATIONS
ROSEVILLE, CAL.
SPARKS, NEV.
CARLIN, NEV.
OGDEN, UTAH
LARAMIE, WYO
N. PLATTE, NEB.
CO BLUFFS, IOWA
WATERLOO, IOWA.
BLUE ISLAND, ILL.
MARION, OHIO.
HORNELL, N.Y.
JUNE 19 | JUNE 20 | JUNE 21 | JUNE 22 | JUNE 23 | JUNE 24 | JUNE 25 | JUNE 26 | JUNE 27 | JUNE 28 | JUNE 29 | JUNE 30 | JULY 1

Fig. 24.—Temperature of the fruit in transit with *salted ice*. Record of temperatures in P.F.E. 7913, plums and figs—Newcastle, California, to New York, N. Y., loaded 10 high. Standard refrigeration with about 2 per cent salt. Route, S.P.—U.P.—I.C.—I.H.B.—Erie. (Courtesy of Standardization Department, California Fruit Exchange.)

TABLE 5

STANDARD SHIPPING PACKAGES FOR GRAPES IN CALIFORNIA (1924)

Type	Usual designations	Total depth required inside	Depth without cleats (inside)	Width inside	Length outside	Uses
1. Lug	Standard No. 1. California shipping. Los Angeles.	*6 7/16 in. or *5 3/4 in.	5 3/4 in.	13 3/4 in.†	17 1/2 in.	Field packing "juice" grapes. Field packing table grapes. Picking boxes.
2. Lug	Standard No. 2. A. F. W.	5 7/16 in.	4 3/4 in.	13 3/4 in.†	17 1/2 in.	Field packing table grapes. House packing freshly picked table grapes.
3. Lug	Standard No. 3. Earl.	4 15/16 in.	4 1/4 in.	13 3/4 in.†	17 1/2 in.	House packing table grapes, the stems of which have been allowed to wilt.
4. Crate	(*a*) Four basket. (*b*) Two basket.	4 15/16 in.	4 1/4 in.	16 in.	17 1/2 in.	House packing table grapes, the stems of which have been allowed to wilt.
5. Lug	Sawdust lug.	7 1/2 in.	(No cleats)	13 3/4 in.†	17 1/2 in.	Sawdust packing table grapes, primarily for early sale.
6. Keg	Grape keg. Sawdust keg.	(Cubic capacity 2642 cu. in.)				Sawdust packing table grapes, primarily for cold storage or boat shipment.
7. Drum	Grape drum.	(Cubic capacity 2642 cu. in.) Depth 14 in., diameter 15 1/2 in. inside)				Sawdust packing table grapes.

* This lug may be used as a standard package with or without the 11/16 inch cleats beneath the lid.

† The legal specifications are 14 in. for the width of these lugs. A 1/4 in. variation, however, is permitted and 13 3/4 in. is the width commonly used.

SUMMARY

1. From 1900 to 1924, the shipments of fresh grapes from California increased from 765 to 52,358 or 70 times, an average of 20 per cent a year (see page 3).

2. Suitable methods of handling, packing and shipping table grapes have been developed during this period which are, on the whole, satisfactory but are imperfectly understood by some growers.

Harvesting.

3. The quality of table grapes depends greatly upon picking at the proper degree of ripeness (see page 4).

4. The legal lower limit of this degree is determined by the sugar percentage as shown by the hydrometer test (see page 6).

5. The pickers are guided in harvesting by the color and appearance of the grapes which have been shown to correspond with the required hydrometer test (see page 7).

6. The grapes are picked into strong boxes sufficiently deep for one layer of bunches placed "stems up" and light enough when filled to be handled easily by one man (see page 8).

7. The bunches should be cut from the vine, handled by the stem only, and great care exercised to avoid all bruising or removal of bloom (see page 9).

8. The bunches should be placed in the picking box with the stems up in order to facilitate their removal by the packers without injury.

9. The boxes should be placed in the shade as soon as filled and taken to the packing house or car as soon as possible (see page 10).

9. The boxes should be placed in the shade as soon as filled and taken to the packing house or car as soon as possible.

10. Shaking and bruising in transporting the filled boxes should be carefully avoided. Light trucks with springs for the vineyard and light auto trucks with pneumatic tires for the road are best (see page 10).

Packing.

11. Some kind of a building or shed is almost necessary for the packing of the grapes, except those "field packed." This building need not be elaborate or expensive and may vary from an open shed with a dirt floor to a large brick building (see page 11).

12. Various types of organization adapted to various purposes and conditions are in use for the packing and marketing of the fruit (see page 12).

13. The packing house must be equipped for box making, weighing, handling and packing the fruit (see page 13).

14. It should be so arranged that all the operations can be done with the least possible labor and the greatest speed compatible with proper and efficient work (see page 19).

15. Packing may be done in the field or in a special packing house. Field packing may be used to advantage if shipping facilities are good, and capable field packers can be obtained and if the fruit is of good quality, requiring but little or no trimming. When shipping facilities are such that the fruit cannot be loaded into the car before it has a chance to wilt, or skilled field packers cannot be obtained, or if the fruit requires considerable trimming, the house pack has proved to be better and cheaper (see page 20).

16. For field packing, or for packing very fresh grapes in packing houses, lug boxes are preferred by most growers and packers. The No. 1 Standard (Los Angeles) and No. 2 Standard (A. F. W.) are used chiefly. Where the grapes are allowed to wilt before packing, the No. 3 Standard (Earl) lug and the Standard 4-basket crate may be used. The popularity of lug boxes has increased rapidly in recent years, but certain markets still show a preference for crates (see page 24).

17. There are three principal methods of arranging the grapes in the container: "Jumble pack" for local trade and juice grapes; "Stems-up" for packing in lugs; "Plain-pack," for grapes of which the appearance is important, in crates or lugs. The "Cluster" pack is used rarely (see page 28).

18. Grapes for sawdust packing should be selected and trimmed in the vineyard. Varieties for this purpose should have good keeping qualities, firm texture, tough skin and fairly loose bunches. Only the Emperor and Ohanez are commonly packed in this way. The sawdust used must be dried, sifted and made free from dust and splinters by a special process (see page 31).

Shipping.

19. Careful loading and bracing are essential. The boxes must be stacked regularly so as to permit of good air circulation. Bracing should be well done to prevent shifting in transit (see page 36).

20. The car should be cool when loaded. Pre-cooling has not proved of sufficient benefit to warrant the building of a plant for grapes alone. Salt at the rate of 2–4 per cent added to the ice at the time of loading and at the first re-icing is advantageous in reducing the temperature in the car. Care must be taken not to use too much salt or the temperature will be lowered to an injurious degree. Unless the car is equipped with a floor rack, basket ice bunkers and solid insulated bulkheads, salt cannot be used (see page 37).

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